United States Department of Agriculture
Natural Resources Conservation Service
April 2006

CSP Activity Sheet ESM-41 and 42

Reducing Soil Compaction

Spring Watershed

Conservation Security Program (CSP) **Soil Management Enhancement**

ESM-41: Reducing soil compaction by controlling areas of traffic.

ESM-42: Reducing soil compaction by using GPS or other similar guided measure.

ESM 41 Reduce soil compaction by controlling areas of traffic that result in a Soil Tillage Intensity Rating (STIR) of less than 15; or between 16 and 30; or between 31 and 60.

CSP Payment:

- STIR of 15 or less; the enhancement payment is $2.00 per acre per year.
- STIR between 16 and 30; the enhancement payment is $1.00 per acre per year.
- STIR between 31 and 60; the enhancement payment is $0.50 per acre per year.

Documentation Required for Payment: A description of the system of control traffic, including fields being applied to and equipment being used. The Soil Tillage Intensity Rating (STIR) is calculated by NRCS.

ESM 42: Using GPS or other similar guided measure technology, reduce soil compaction by controlling areas of traffic that result in a Soil Tillage Intensity Rating (STIR) of less than 15; or between 16 and 30; or between 31 and 60.

CSP Payment:

- STIR of 15 or less; the enhancement payment is $4.00 per acre per year.
- STIR between 16 and 30; the enhancement payment is $2.00 per acre per year.
- STIR between 31 and 60; the enhancement payment is $1.00 per acre per year.

Documentation Required for Payment: A description of the system of control traffic, including fields being applied to and equipment being used. The Soil Tillage Intensity Rating (STIR) is calculated by NRCS.

CSP enhancements must be included in the CSP *CCC-1200 Conservation Program Contract* to be eligible for payment. CSP participants must maintain records and information to document compliance with their CSP Contract and requirements of CSP. CSP participants should review their *CCC-1200* and *CCC-1200 Appendix* for their CSP enhancement application schedule details.

CSP Enhancements earnings are subject to payment caps and that actual payments will depend on the CSP Tier level, the land area affected, and the number of activities.

It is the CSP participant's responsibility to obtain all necessary permits and to comply with all laws, regulations and ordinances pertaining to the application of CSP activities.

Details of Enhancement Activity and Requirements:

Reducing Soil Compaction by Controlling Areas of Traffic

Soil that is excessively compacted is limited in its ability to function. Soil compaction occurs when moist or wet soil particles are pressed together and the pore spaces between them are reduced. Adequate pore space is essential for the movement of water, air, and soil fauna through the soil. The mechanical strength and poor oxygen supply of compacted soil restricts root penetration. Soil moisture is unavailable if layers of compacted soil restrict root growth. Compaction restricts infiltration, resulting in excessive runoff, erosion, nutrient loss, and potential water-quality problems. Soil compaction can restrict nutrient cycling, resulting in reduced yields.

Compaction is caused primarily by wheel traffic, but it also can be caused by animal traffic or natural processes. Soil is especially susceptible to compaction when it is at field capacity or wetter, has a low content of organic matter, or has poor aggregate stability. Saturated soils lack adequate strength to resist the deformation caused by traffic. Moldboard plowing and excessive tillage break down soil aggregates. After the aggregates are broken down and the soil surface is bare, the soil is more likely compacted by the excessive vehicle passes common in conventional tillage systems.

A controlled traffic system separates traffic zones from cropping zones within a field. Yields normally improve when traffic is restricted to controlled zones between the rows because the soil directly beneath the rows can retain a loosened structure. A controlled traffic system works well with row crops. If drilled crops are grown, a skip row is required. One component of controlled traffic systems is ensuring that all equipment covers the same width or multiples of the same width. A second component is minimizing the number of traffic lanes.

Table 2 (see page 3) provides examples of traffic patterns. In the first scenario in table 2, the tractor tire spacing is 60" and the combine tire spacing is 120". Thus, each set of six rows will have four tire paths and 44 percent of the ground will be trafficked. By CSP Job Sheet ESM 2 April 2005 increasing the tractor tire spacing to match the combine tire spacing (as in the second row of the table), the number of paths and area trafficked are cut in half. Permanent high residue cropping systems, otherwise known as conservation tillage systems, generally work well with controlled traffic systems because previous crop rows are not tilled and thus traffic rows remain visible. Controlled traffic can be an integral part of ridge-till systems and no-till systems with permanent beds.

Mulch tillage systems (systems with tillage across the entire field) require autosteer technology (Sandusky, 2003) using guidance from a Global Positioning System (GPS) to locate traffic lanes year after year. Auto-steer technology keeps all field operations in the same traffic lanes. Some systems are even capable of 1-inch accuracy. This technology allows controlled traffic with standard agricultural equipment and full-width tillage. Automatic steering and controlled traffic reduce compaction beneath the row, thereby increasing infiltration and reducing the hazard of erosion and the need for sub-soiling.

Table 2. Examples of traffic patterns for controlled traffic systems					
Row Spacing (in)	Number of rows	Tractor (in)	Combine (in)	Number of paths	% Trafficked
30	6	60	120	4	44
30	6	120	120	2	22
30	8	120	120	2	17
30	8	60 & 120	120 & 180	6	50
30	12	60 & 120	120 (6-row)	4	22
30	16	60 & 120	120 & 180 (8-row)	8	33
30	24	60 & 120	120 & 180 (12-row)	12	33
36	6	72	144	4	37
36	8	72	144	4	28
36	12	72	144	4	18

Using GPS or other similar guided measure technology, to reduce soil compaction by controlling areas of traffic